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C16-M–302

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BOARD DIPLOMA EXAMINATION, (C-16)

JUNE/JULY—2022

DME - THIRD SEMESTER EXAMINATION

STRENGTH OF MATERIALS

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. A steel rod 2 m long is fixed rigidly at the ends and heated through a temperature of 100 °C. Find the stress induced in the rod, if $\alpha_s = 12 \times 10^{-6}$ per °C and $E_s = 2 \times 10^5$ N/mm^2.

2. Write the relation between the three elastic constants.

3. Calculate the elastic strain energy per unit volume due to extension of a steel bar having an elastic limit of 200 N/mm^2 and $E_s = 2 \times 10^5$ N/mm^2.

4. A thin cylindrical shell is subjected to internal fluid pressure. How is the circumferential stress related to the longitudinal stress?

5. A simply supported beam of 2 m long carries a point load of 5 kN at the midpoint. Draw the shear force and bending moment diagrams.

6. Find the section modulus of a hollow circular cross-section of external diameter 200 mm and thickness 25 mm.

7. A cantilever 1 m long of section 100 mm wide × 150 mm deep carries a concentrated load of 50 kN at free end. Find the deflection at free end. Take $E = 2 \times 10^5$ N/mm^2.

8. Write the torsion equation for shafts.

9. A solid shaft of diameter 10 mm is subjected to a torque of 18 Nm. Find the angle of twist over a length of 250 mm. Take $G = 0{\cdot}8 \times 10^5$ N/mm^2.

10. Define the term 'stiffness' in springs.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. A mild steel tube of internal diameter 20 mm and thickness 5 mm is tightly fitted inside a hollow copper tube of equal thickness. The ends of both the tubes are brazed together and the composite bar is subjected to an axial pull of 40 kN. E for steel and copper are 2×10^5 N/mm^2 and 1×10^5 N/mm^2 respectively. Find the stresses developed in both the materials.

12. A bar of 10 mm diameter gets stretched by 3 mm under a steady load of 7·5 kN. What stress would be produced in the same bar by a weight of 750 N, which falls vertically through a distance of 75 mm on to a rigid collar attached to its end? The bar is initially unstressed. Take $E = 2 \times 10^5$ N/mm^2.

13. A cylindrical shell 4 m long, 1 m diameter and 12 mm thickness is subjected to an internal pressure of 1·5 N/mm^2. Calculate the longitudinal and hoop stresses, changes in diameter, length and volume. Take $E = 2 \times 10$ N/mm^2, $\frac{1}{m} = 0{\cdot}3$.

14. Draw shear force and bending moment diagrams for a beam 10 m long with equal overhangs of 2 m carrying a uniformly distributed load of 1 N/m over its length.

15. A beam of symmetrical I-section is simply supported over a span of 9 m. The total depth of section is 220 mm. If the maximum stress is not to exceed 80 N/mm^2; what is the concentrated load that can be carried at the middle of the span? Assume MI about neutral axis as 2706×10^4 mm^4.

16. A cantilever 1·8 m long carries two loads each 'W', of which one is at the free end and the other at 1·2 m from fixed end. Moment of inertia of the cantilever section is 20×10^5 mm^4. Calculate the value of 'W' to give a maximum deflection of 8 mm. Take E = 200 GPa.

17. Determine the maximum torque that can be applied to a hollow circular steel shaft of 100 mm outside diameter and 80 mm inside diameter without exceeding a shear stress of 65 MPa or a twist of 2° over a length of 4 m. Take G = 80 GPa.

18. A carriage spring of 750 mm length is built up of plates 70 mm wide and 8 mm thick. How many plates are necessary to support a central load of 10^4 N without exceeding the stress of 160 N/mm^2? Find out central deflection. Take $E = 2 \times 10^5$ N/mm^2.

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